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COMPENSATING PYROMETER WITH AN ADJUSTABLE THERMOCOUPLE

B. D. Katsnel'son and V. V. Promerantsev
Cen Sci Res Boiler and Turbine Inst imeni I. I. Polzunov.

Measuring gas temperature in a chamber filled with gas, in the presence of a radiation source with a temperature higher or lower than that of the gas, is very difficult. Existing pyrometers are unsatisfactory because of the insufficient accuracy of their readings, complexity, and inconveniences in measuring.

The new instrument developed in the Central Scientific Research Boiler and Turbine Institute is a type of compensating pyrometer. Its performance is based on compensating the error in readings of the thermocouple with the aid of an incorporated electric heater which secures additional heating in case of cold surfaces, and cooling with the aid of a water jacket in the presence of surfaces hotter than the gas itself. The compensation is executed by moving the thermocouple along the heated or cooled tube through which gas is drawn off. Upon changes in the speed of drawn gas the thermocouple readings also vary, rising with an increase of speed in the case of a cold radiation source and dropping with a hotter radiation source. The real value of gas temperature must be shown by the invariable reading of the thermocouple at various speeds of gas flow.

The new instrument should find application in precise gas temperature measurements in furnaces, gas pipes of boilers, ovens, and other similar appliances.

Testing of the experimental instrument was conducted in an oil-heated furnace and chain-grate coal stoker. The cold shield was placed in both chambers and therefore the pyrometer operated with the electric heater switched-in.

Checking of pyrometer performance in determination of gas temperature in the case of a hot radiation source was conducted under laboratory conditions during investigation of the heat exchange in the fuel layer. In this case the construction of the pyrometer is considerably simplified by elimination of the electric heater. Running water in a jacket performed additional cooling. Experimental conditions permitted using the pyrometer only up to 165°C. However even under these conditions the sensitivity of the instrument was sufficiently high.

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In spite of the somewhat more complicated construction of the instrument as compared with other existing pyrometers, its operation is very simple, since obtaining the two similar readings at two sharply different rates of gas flow is sufficient for determining the real temperature of the gas. Complete compensation is attained in 1-2 minutes.

In conclusion, it is to be noted that the pyrometer described here, giving more precise readings than other instruments, has the following special features:

1. Dependable compensation of temperature readings may be achieved by drawing off a small amount of gas, thus avoiding the use of complicated high-power ejectors.

2. In contrast to instruments of the Schmidt type, this pyrometer is not sensitive to voltage variations in an electric power line.

3. The instrument may be used for measuring gas temperature in cases of hot radiation surfaces as well as in the presence of cold ones.

4. The movement of the thermocouple for compensation does not involve any particular structural complications.

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